



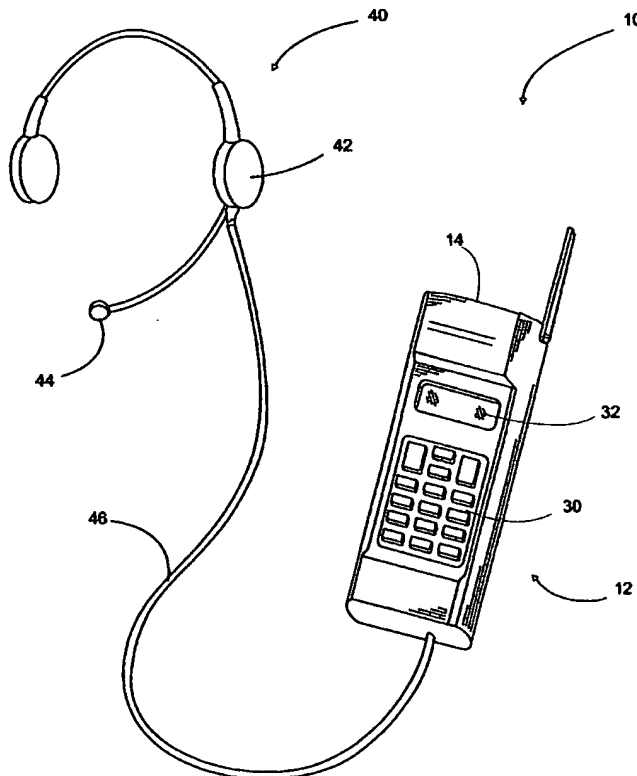
## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>6</sup> : H04M 1/72, 1/60		A1	(11) International Publication Number: WO 99/43136
			(43) International Publication Date: 26 August 1999 (26.08.99)
(21) International Application Number: PCT/US99/00570		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).	
(22) International Filing Date: 11 January 1999 (11.01.99)			
(30) Priority Data: 09/025,395 18 February 1998 (18.02.98) US			
(71) Applicant: ERICSSON, INC. [US/US]; P.O. Box 13969, Research Triangle Park, NC 27709-3969 (US).			
(72) Inventors: RYDBECK, Nils, R., C.; 202 Rutherglen, Cary, NC 27511 (US). FUSSELL, John, P.; 2844 Mattlyn Court, Raleigh, NC 27613 (US).			
(74) Agents: BENNETT, David, E. et al.; Rhodes, Coats & Bennett, LLP, P.O. Box 5, Raleigh, NC 27602 (US).		Published With international search report.	

(54) Title: CELLULAR PHONE WITH EXPANSION MEMORY FOR AUDIO AND VIDEO STORAGE

## (57) Abstract

A cellular telephone includes an internally integrated digital entertainment module. The telephone includes a transceiver unit and a headset which is connected to the transceiver unit by wired or wireless link. The entertainment module includes an interchangeable ROM and/or expansion RAM for storing music or other audio signals for playback through the telephone's headset. Music or other audio signals in digitized form is stored in the interchangeable ROM or is loaded into the expansion RAM from a CD player, computer, or other source of digitized audio signals. Under control of the cellular telephone's microprocessor, the digitally stored audio signal is played back through the telephone's headset. The entertainment module may be located in the transceiver unit, a removable battery pack, or in a separate adapter.



**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakhstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

**CELLULAR PHONE WITH EXPANSION MEMORY  
FOR AUDIO AND VIDEO STORAGE**

**FIELD OF THE INVENTION**

The present invention relates generally to mobile communication devices, and more particularly to portable radio communication devices having an integral entertainment module including RAM or ROM for storing audio, video and/or still images.

**BACKGROUND OF THE INVENTION**

In the past two decades, advances in digital electronic technology have led to a rapid growth in the area of entertainment oriented consumer electronic devices. In particular, portable electronic devices such as audio CD players, FM/AM radio receivers, and even television or video tape/disc players have become increasingly popular among consumers as they have become small, lightweight, and easy for an individual to carry.

While quite popular with consumers, the mass storage type devices (audio CD, video tape/disc) typically suffer from motion induced distortion otherwise known as bouncing or skipping. These problems arise, in part, as a result of the required motion of the mass storage medium during normal operation. That is, in the case of an audio CD or a video disc, the disc which comprises the storage medium is typically spun or rotated at a relatively high speed while the information stored on the disc is read by an associated read head. Proper and precise alignment of the read head with respect to the spinning storage medium must be maintained at all times in order to insure error free reading of the stored data. Such precise alignment is often difficult to maintain when the audio or video player is being used in manner which is conducive to extreme vibration or mechanical shock. In practice, mechanically harsh

activities such as jogging or running are common among users of portable electronics, particularly with regard to the use of portable audio CD players. In such cases, skipping or bouncing artifacts induced in the CD player can seriously impair the overall performance of the player.

With further regard to the recreational athletic activities of portable electronics consumers, it is often the case such consumers will carry not only an audio CD player for entertainment purposes, but also a cellular telephone for safety and security. Although such equipment provides the desired entertainment/security services to the athletically active consumer, the need to carry multiple pieces of equipment is generally viewed as inhibiting or impairing to their athletic endeavors.

Therefore, there is and continues to be a need for a practical and efficient technique for incorporating the functionality of audio and/or video playing devices within wireless communications devices such as cellular telephones.

#### SUMMARY OF THE INVENTION

The present invention is a cellular telephone particularly adapted for leisure activities. The cellular telephone of the present invention includes a portable transceiver unit and a headset which can be worn by the user during leisure activities such as jogging, biking, gardening, etc. The transceiver unit includes a fully functional transceiver capable of sending and receiving voice and data signals via an RF carrier. The transceiver unit has an integral digital entertainment module including a memory for storing music or other audio signals for playback through the headset. For purposes of this application, memory means all forms of computer memory but does not include disk storage, tape storage or other memory requiring electromechanical read systems. The memory may be in the form of a removable ROM cartridge and/or an expansion RAM. In those embodiments having an

expansion RAM, an input port is provided for loading music or other audio signals into the expansion RAM from a CD player, computer, or other source of digitized audio.

Under the control of the transceiver unit's microprocessor, the digitally stored audio signal is played out through the telephone's headset, which in the preferred embodiment comprises stereo headphones. The headset may be connected to the phone by a wired or wireless link. Because of its integration into the cellular phone, the digital entertainment module can share components already present in the cellular phone. Such savings would not be available if a CD player were simply aggregated with the phone. Further, the use of solid state RAM or ROM, as opposed to disc storage, eliminates the need for bounce control circuitry. This enables the disclosed invention to provide cellular communications and entertainment during leisure activities.

In another aspect of the present invention, the digital entertainment module could be located in a removable battery pack which attaches to the transceiver unit, or in a separate adapter which plugs into the transceiver unit. Locating the digital entertainment module in either a battery pack or separate adapter allows the manufacturer to offer the digital entertainment module as an optional accessory which does not need to be purchased at the same time the cellular phone is purchased. This allows consumers who purchase a phone without the digital entertainment module to later purchase the battery pack or adapter as an upgrade to the existing phone.

### BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view of the portable communication device of the present invention.

Figure 2 is a block diagram of the portable communication device.

Figure 3 is a block diagram of the entertainment module contained in the portable communication device.

Figure 4 is a perspective view of a second embodiment of the portable communication device in which the digital entertainment module is located in a removable battery pack.

Figure 5 is a block diagram showing the second embodiment of the portable communication device in which the entertainment module is located in a removable battery pack.

Figure 6 is a perspective view of a third embodiment of the portable communication device in which the digital entertainment module is located in a separate adapter with attaches to the transceiver unit.

Figure 7 is a block diagram showing the third embodiment of the portable communication device in which the entertainment module is located in a separate adapter.

### DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawings, and particularly to Figures 1 through 3, the cellular phone of the present invention is shown therein and indicated generally by the numeral 10. The cellular phone 10 of the present invention is particularly adapted for use during leisure activities such as jogging, hiking, gardening, etc.

The cellular phone 10 includes a transceiver unit 12 and a headset 40 which can be worn on the head by the user. The transceiver unit 12 includes a main

housing 14 and a removable battery pack 16 containing a rechargeable battery 28. Housing 14 of the transceiver unit 12 contains an RF transceiver 18, control logic 20, program memory 22, and audio processing unit 24 which are operatively connected by a system bus 26. The RF transceiver 18 may be, for example, a class 1 mobile phone transceiver capable of transmitting and receiving radio signals containing voice and/or data. Audio processing unit 24 processes voice and data signals that are transmitted and received by the transceiver 18. Audio processing unit 24 may include voice recognition circuitry to enable activation and use of the phone 10 by voice commands for truly hands-free operation. The control logic 20 controls the operation of the transceiver 18 according to instructions stored in program memory 22. A keypad 30 and display 32 provide a user interface. Keypad 30 enables the user to enter dialing instructions and commands to initiate a call, and to select options. The display 32 displays the number dialed and call status information to the user. Display 32 may also display instructions or options to the user. Unlike a conventional cellular phone, the transceiver unit 12 of the present invention does not include an internal microphone and speaker, though such is within the scope of the contemplated invention.

The headset 40 includes stereo speakers 42 and microphone 44 that are connected to the transceiver unit 12 by a cable 46. Cable 46 may include a plug (not shown) which removably mates with a corresponding jack on the transceiver unit 12. The cable 46 connects to the system bus 26 which routes audio signals from the audio processing unit 24 to and from the headset 40 under the control of the microprocessor 20. The jack could also connect directly to audio processing circuit 24. Alternatively, the headset 40 could communicate wirelessly with the transceiver

unit 12, for example, by means of an infrared carrier, low power RF carrier or magnetic link.

The portable telephone 10 of the present invention includes a built-in digital entertainment module 50 (DEM) which allows music or other audio signals to be "played-back through the cellular telephone's headset 40. The entertainment module 50 includes extended RAM and/or removable memory cartridges for storing music or other audio signals which can be played back through the headset 40 of the phone 10.

Referring now to Figure 3, a schematic diagram of the digital entertainment module 50 is shown. The digital entertainment module 50 includes a secondary bus 52, extended random access memory (RAM) 54, removable ROM 56, and an input 58. The extended RAM 54 may, for example, be a flash EPROM chip capable of storing digitized audio. Digitized audio is loaded into the flash EPROM via input 58. The input 58 may be a serial port, parallel port, infra-red data port, modem, or any other type of input device capable of interfacing with a source of digitized audio, such as a CD player, or computer. It is also contemplated that audio may be obtained from the transceiver unit 12 in an "internet-enabled" phone 10. The removable ROM 56 is preferably in the form of a cartridge which fits into a slot in the transceiver unit 12. The ROM cartridge 54 would contain pre-recorded music which could be purchased by the user. In the preferred embodiment, the data format of both the extended RAM 54 and removable ROM 56 would be organized according to CD-ROM standards, which is 14 bits per sample and 44.1 k samples per second.

In operation, the user would insert a removable ROM cartridge 56 into the transceiver unit 12 or load audio into the extended RAM 54 from a CD player, computer, or other source of digitized audio. The transceiver unit 12 is attached the



belt or other article of clothing worn by the user. The headset 40 is placed on the user's head and connected to the transceiver unit 12. Playback of audio in the extended RAM 54 or removable ROM 56 could be activated via the keypad 30, or alternately, by voice command. The audio would be played back through the headset 40 under control of the microprocessor 20 while the user engages in leisure activities. When an incoming call is received, the microprocessor 20 automatically mutes or stops the playback of audio from the digital entertainment module 50 until the call is terminated. Preferably, the transceiver unit 12 includes a preferred caller list stored in a screening memory which may be part of program memory 22 or separate therefrom but in communication with the control logic 20. This preferred caller list is used to screen incoming calls such that only calls from callers on the preferred caller list cause the playback of audio from the digital entertainment module 50 to be muted or stopped; calls from callers not on the preferred caller list preferably do not cause such response. Upon termination of the call, the microprocessor 20 would unmute or restart the playback of audio from the digital entertainment module 50.

A significant advantage of the present invention is that audio is played back from solid state RAM or ROM memory thus eliminating the need for bounce control circuitry which is commonly used in portable CD players. Further, because of its integration into the cellular phone 10, there is no need for the user to carry both a portable audio player and a cellular phone. Moreover, integration of the entertainment module 50 into the cellular phone 10 allows the entertainment module 10 to share components with the cellular phone 10 to take advantage of the phone's communication capability to load the RAM 54. Thus, the present invention could

replace both a conventional cellular phone and portable audio player at lower cost than a conventional walk-man and telephone.

Referring now to Figures 4 and 5, a second embodiment of the present invention is shown. The second embodiment is similar to the first embodiment and, therefore, the same reference numerals will be used to identify similar components. As shown in Figures 4 and 5, the second embodiment of the phone 10 includes a transceiver unit 12 with a removable battery pack 14, and a headset 40 connected to the transceiver unit 12. The transceiver unit 12 includes a transceiver 18, microprocessor 20, program memory 22, audio processing circuits 24, keypad 30 and display 32 as previously described. Similarly, the headset 40 includes stereo speakers 42 and microphone 44. The second embodiment differs from the first in that the digital entertainment module 50 is contained within the removable battery pack 14. The entertainment module 50 connects to a secondary bus in the battery pack 14. When the battery pack 14 is attached to the transceiver unit 12, a connection is made between the secondary bus in the battery pack 14 and the main bus 26 of the transceiver unit 12. The main bus 26 and secondary bus enable the routing of audio signals between the entertainment module 50 and audio processing circuits 24 under the control of the microprocessor 20.

Figures 6 and 7 show a third embodiment of the present invention. The third embodiment is similar to the first and second embodiments and therefore the same reference numbers will be used to identify similar components. As shown in Figures 6 and 7, the third embodiment includes a transceiver unit 12, headset 40, and adapter 70. The transceiver unit 12 includes a transceiver 18, microprocessor 20, program memory 22, audio processing circuits 24, keypad 30, and display 32. In addition, the transceiver unit 12 in the third embodiment includes an internal

microphone and speaker 34 and 36 respectively. Thus, the transceiver unit 12 can be used without the headset 40.

The headset 40 includes a pair of stereo speakers 42 and microphone 44. The headset 40 is connected by a cable 46 to the adapter 70. The entertainment module 50 is contained in the adapter 70. The adapter 70 includes a secondary bus 72 which connects to the main bus 26 on the transceiver unit when the adapter 70 is plugged into the transceiver unit 12. An input/output circuit 74 routes audio signals to and from the headset 40.

When the transceiver unit 12 is used without the adapter 70, audio signals are routed under the control of the microprocessor from the audio processing circuits 24 to the internal microphone and speaker 34 and 36. When the adapter 70 is plugged into the transceiver unit 12, the audio signals are routed to the microphone 44 and speakers 42 on the headset 40.

The configuration of the phone 10 shown in Figures 6 and 7 is advantageous in that it allows the transceiver unit 12 to be sold without the digital entertainment module 50 and later upgraded by the consumer. The adapter 70 and headset 40 could be sold separately as an accessory or at a later time as an upgrade. Thus, a single phone could be manufactured for use both with and without the digital entertainment module 50.

It will be apparent to those skilled in the art that the digital entertainment module 50 could also be used to store video or still images which could be output to the display 32 of the transceiver unit 12. Any sound accompanying the video would be played back through the headset 40 or internal speaker. It should also be apparent that the digital entertainment module 50 could include a broadcast receiver

for receiving conventional radio and TV broadcasts in addition to its entertainment memory.

The present invention may, of course, be carried out in other specific ways than those herein set forth without departing from the spirit and essential characteristics of the invention. The present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.

**CLAIMS**

What is claimed is:

1. A mobile radio communication device comprising:
  - a. a transceiver unit for transmitting and receiving audio signals;
  - b. a speaker operatively connected to said transceiver unit for converting audio signals received by said transceiver unit into audible signals which can be heard by a user;
  - c. a microphone operatively connected to said transceiver unit for converting the user's voice into audio signals for transmission by said transceiver;
  - d. memory operatively connected to said transceiver unit for storing pre-recorded audio for subsequent playback through said speaker.
2. The mobile radio communication device according to claim 1 wherein said memory is an erasable memory.
3. The mobile radio communication device according to claim 1 wherein said memory is an unerasable memory.
4. The mobile radio communication device according to claim 1 wherein said memory is contained in said transceiver unit.
5. The mobile radio communication device according to claim 1 further including a removable cartridge insertable into said transceiver unit, wherein said memory is contained in said removable cartridge.

6. The mobile radio communication device according to claim 1 further including a removable battery pack attachable to said transceiver unit, said memory being located in said battery pack.

7. The mobile communication device according to claim 1 further including a detachable adapter for attaching to said transceiver unit, said memory being located in said adapter.

8. The mobile radio communication device according to claim 1 further including a headset, wherein said speaker and microphone are mounted to said headset.

9. The mobile radio communication device according to claim 1 further including a input port operatively connected to said memory for loading audio into said memory.

10. The mobile radio communication device of claim 1 further including a screening memory in communication with said transceiver for storing a list of preferred callers and wherein when an incoming call is received during playback of said pre-recorded audio, playback continues unless said incoming call is from a caller on said list of preferred callers.

11. A cellular telephone having an entertainment module for playing pre-recorded audio and video signals comprising:

a. a transceiver for transmitting and receiving audio and data signals;

- b. a microprocessor for controlling the operation of said transceiver;
- c. a signal processing circuit operatively connected to the transceiver and microprocessor for processing signals transmitted and received by the transceiver;  
and
- d. an entertainment module with a memory operatively connected to the microprocessor and signal processing circuits for storing audio and video signals for subsequent playback under the control of said microprocessor.

12. The cellular telephone of claim 11 wherein said memory comprises an erasable and programmable memory for storing and playing audio and video signals.

13. The cellular telephone of claim 12 including an input coupled to the erasable and programmable memory for downloading and storing audio and video signals into said erasable and programmable memory.

14. The cellular telephone of claim 11 wherein said memory comprises a permanent memory which is removable from said cellular telephone for storing and playing audio and video signals.

15. The cellular telephone of claim 11 wherein the entertainment module includes a first memory which is programmable and erasable, an input coupled to said first memory for downloading and storing audio and video signals into said first memory, and a second permanent memory having pre-recorded audio and video signals stored therein.

16. The cellular telephone according to claim 15 wherein said second memory is a removable and interchangeable memory cartridge.

17. The cellular telephone of claim 11 wherein the first and second memories are coupled to a headset port in the cellular telephone, thereby permitting audio signals to be directed from the memories to a headset coupled to the cellular telephone via the headset port.

18. The cellular telephone of claim 11 wherein the microprocessor is pre-programmed to preempt output from said first and second memories in response to an incoming call or the initiation of an outgoing call.

19. The cellular telephone of claim 11 further including a screening memory in communication with said microprocessor for storing a list of preferred callers and wherein said output from said first and second memories is not preempted in response to an incoming call unless said incoming call is from a caller on said list of preferred callers.



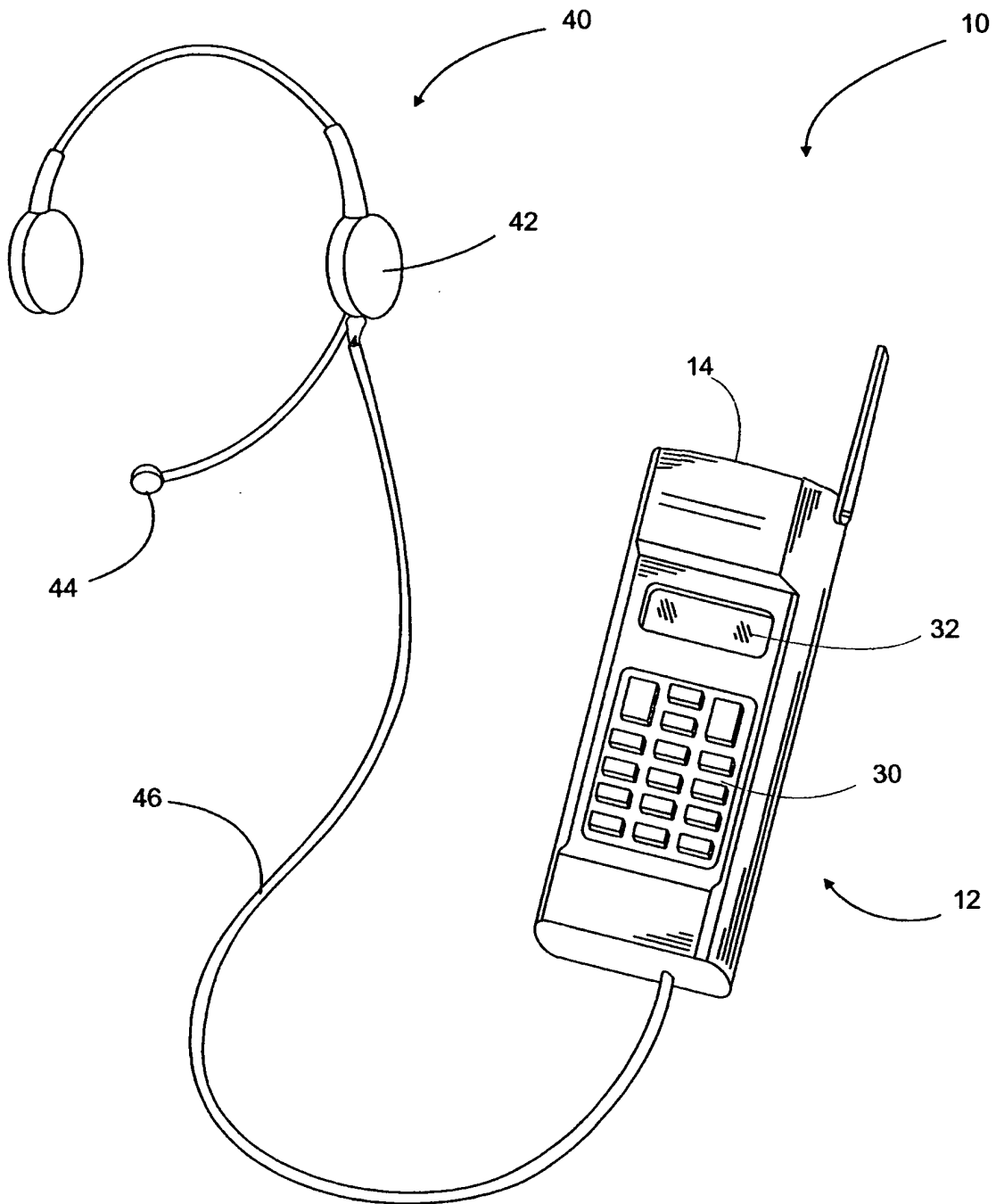


FIG. 1

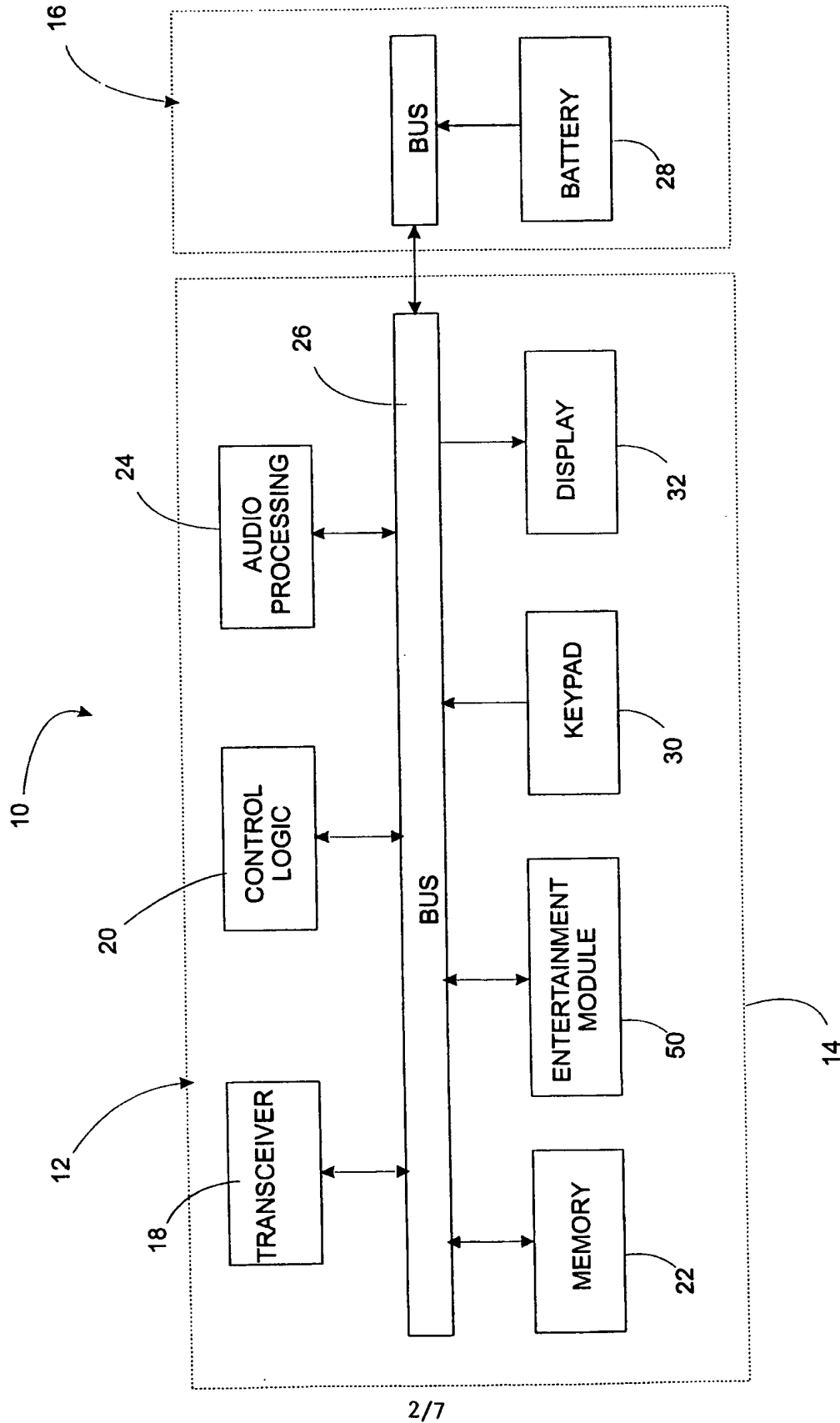


FIG. 2

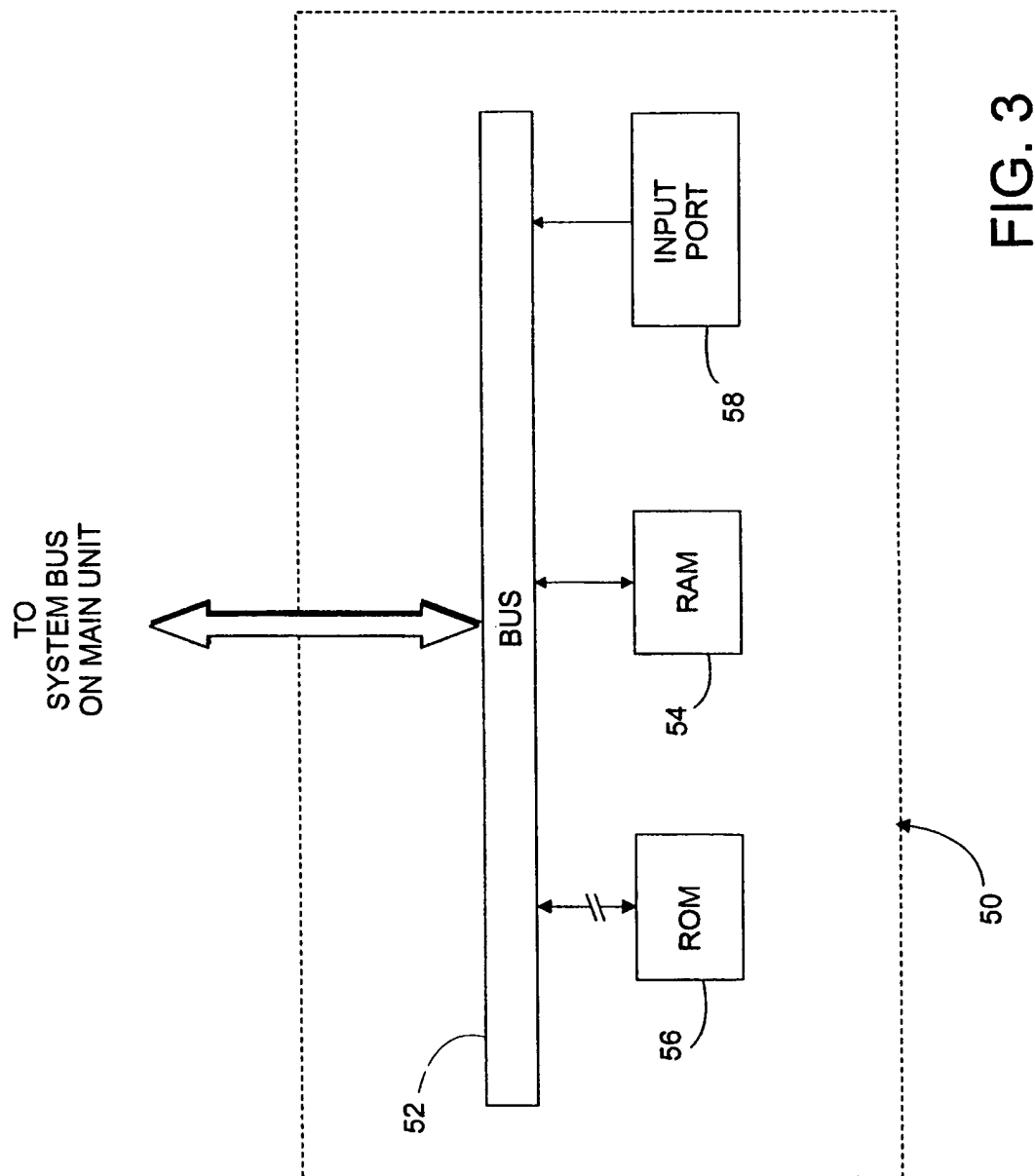


FIG. 3

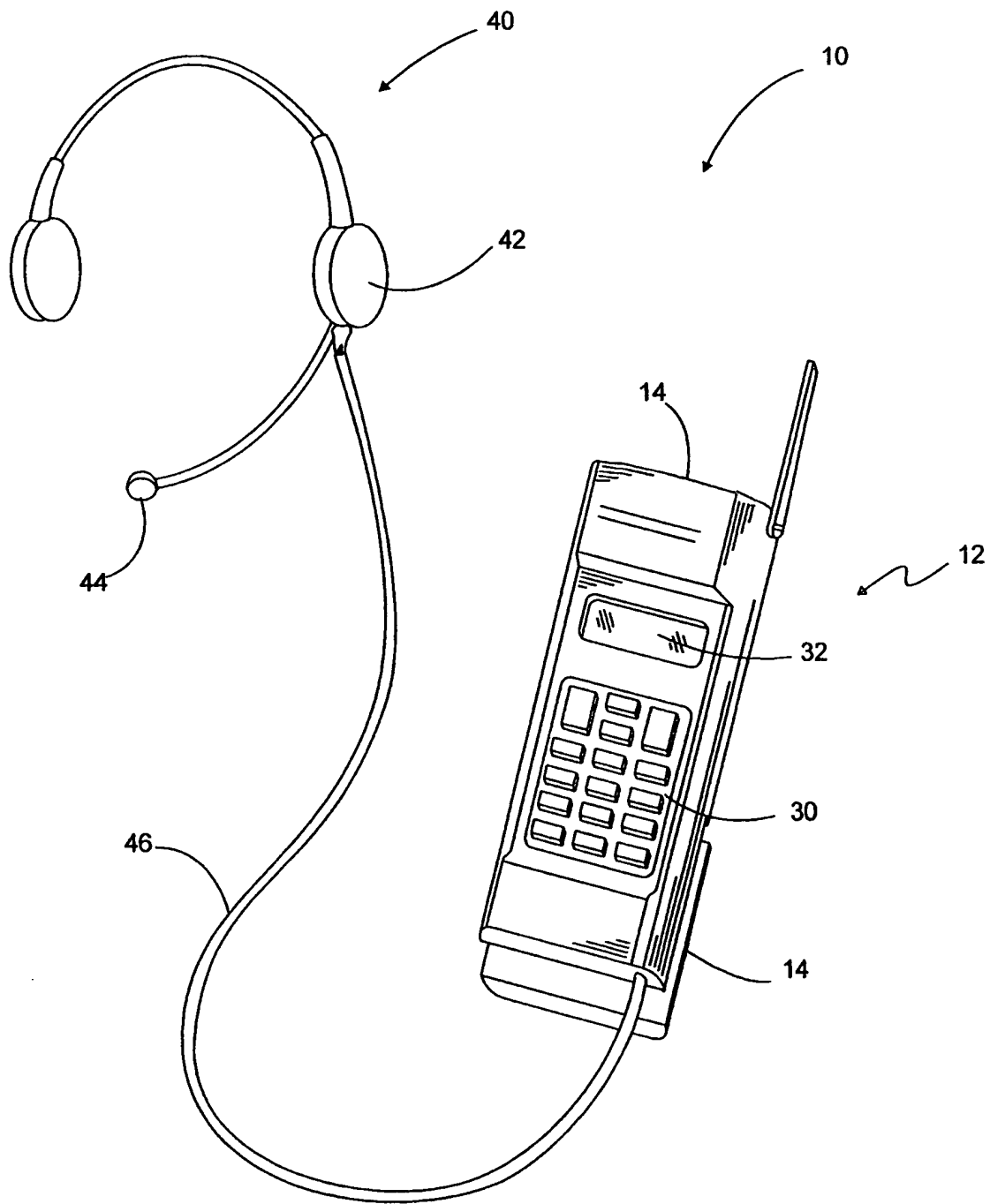


FIG. 4

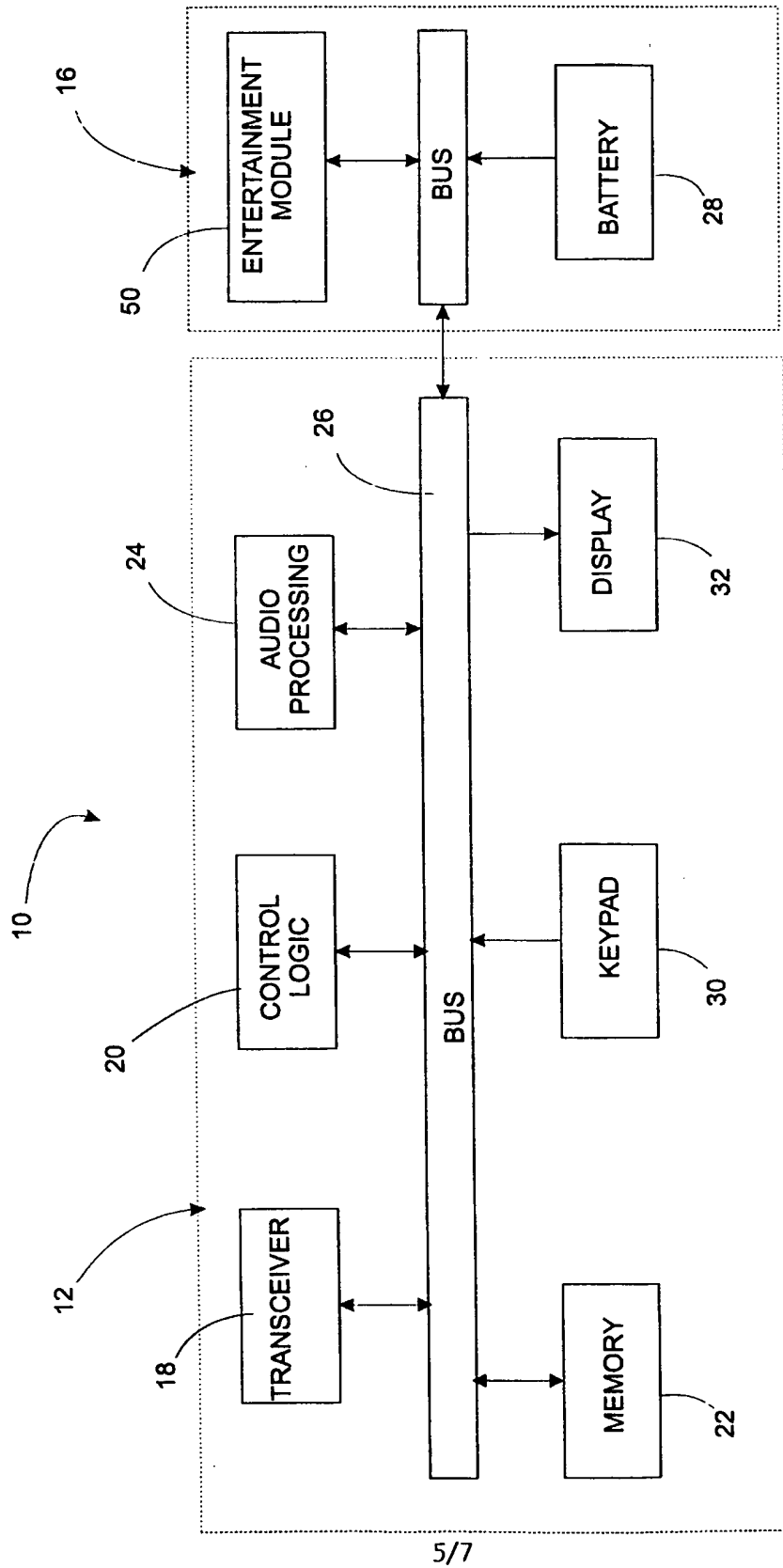


FIG. 5

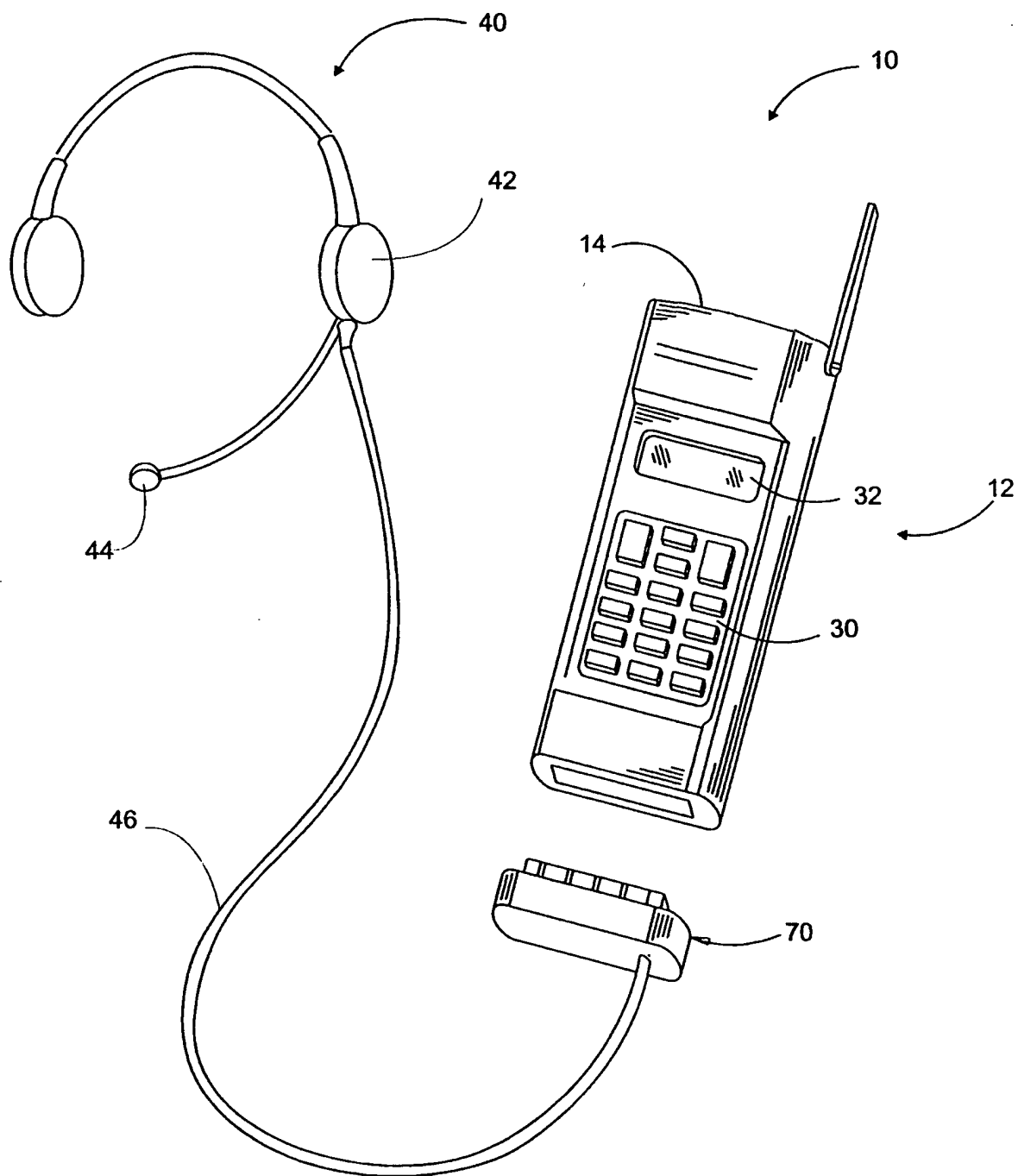


FIG. 6

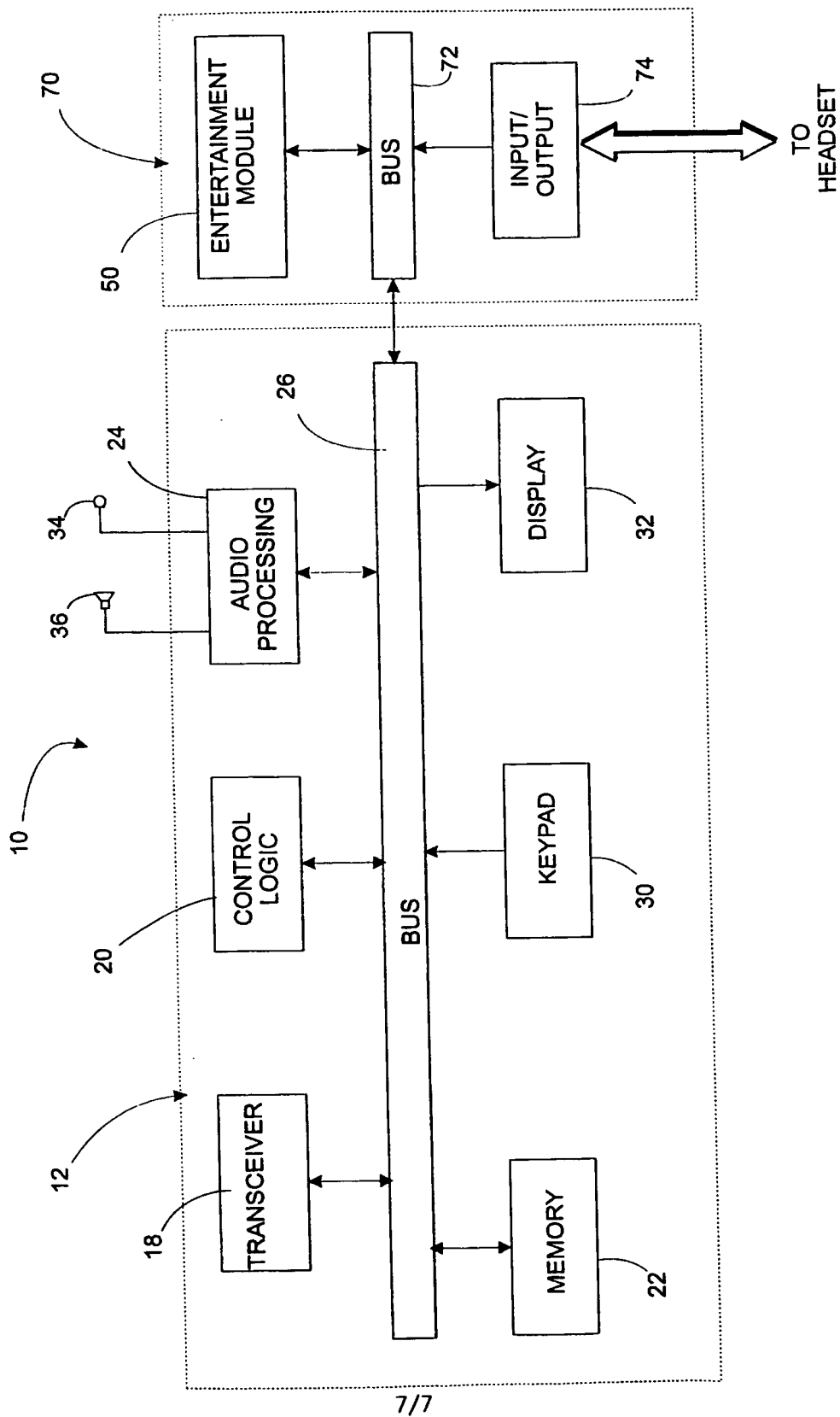


FIG. 7

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 99/00570

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 6 H04M1/72 H04M1/60

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 H04M H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	GB 2 308 775 A (NIPPON ELECTRIC CO) 2 July 1997 see page 6, line 1 - line 26 see page 8, line 9 - page 11, line 17 see page 14, line 6 - line 11 see figures 1,2 ---	1,2,5,8 10,11,18
X A	US 4 481 382 A (VILLA-REAL) 6 November 1984 see column 2, line 29 - line 34 see column 12, line 39 - line 56 see column 13, line 34 - line 50 see figures 6-8 --- -/--	1,2,4,5 11

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

### \* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

21 April 1999

Date of mailing of the international search report

29/04/1999

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Fragua, M



# INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 99/00570

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 875 229 A (SPEAR ET AL) 17 October 1989 see abstract see column 1, line 25 - line 36 see column 2, line 32 - line 55 see figure 1	1,2,5
A	WO 97 26744 A (ROBB) 24 July 1997  see abstract see page 1, line 8 - page 2, line 6 see page 3, line 5 - page 4, line 4 see page 9, line 18 - page 10, line 17 see page 12, line 12 - line 22 see page 15, line 4 - line 16 see page 16, line 20 - line 25 see page 17, line 10 - page 18, line 6 see page 21, line 13 - page 22, line 26 see page 24, line 1 - line 12 see page 25, line 10 - line 22 see page 26, line 1 - page 27, line 5 see figures 3,9	1-5, 11-16
A	GB 2 289 555 A (NOKIA MOBILE PHONES LTD) 22 November 1995 see page 1, line 1 - line 6 see page 4, line 18 - line 23 see page 5, line 20 - page 6, line 2 see page 7, line 1 - page 8, line 9 see page 10, line 5 - line 7 see page 14, line 1 - line 16 see figures 1-3	1,2,4,7, 11-13
A	DE 195 28 424 A (SIEMENS AG) 21 November 1996 see column 1, line 29 - line 34 see column 4, line 68 - column 5, line 64 see column 7, line 36 - line 60 see column 8, line 43 - line 53 see figures 1,2,6	1,2,4, 11,12
A	US 5 550 754 A (WILLIAMS ET AL) 27 August 1996 see abstract see column 7, line 24 - column 8, line 9 see column 11, line 1 - line 34 see column 12, line 24 - column 13, line 27 see column 20, line 54 - column 22, line 4 see figures 8,16,30,31	1,7-9, 11,17
	-/--	

# INTERNATIONAL SEARCH REPORT

In .tional Application No

PCT/US 99/00570

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 665 655 A (HEWLETT PACKARD CO) 2 August 1995 see abstract see column 3, line 29 - column 4, line 5 see column 4, line 44 - column 5, line 1 see figures 3B,6 ---	1,2,6,9
A	US 5 661 788 A (CHIN) 26 August 1997  see abstract see column 2, line 47 - column 3, line 3 see column 3, line 38 - column 4, line 3 see column 4, line 59 - line 67 see figure 1 -----	1,4,10, 11,18,19

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 99/00570

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 2308775 A	02-07-1997	JP 9187060 A AU 7540296 A	15-07-1997 03-07-1997
US 4481382 A	06-11-1984	NONE	
US 4875229 A	17-10-1989	CA 1287374 A	06-08-1991
WO 9726744 A	24-07-1997	AU 1363697 A CA 2243244 A EP 0875109 A	11-08-1997 24-07-1997 04-11-1998
GB 2289555 A	22-11-1995	FI 942334 A	20-11-1995
DE 19528424 A	21-11-1996	WO 9635288 A EP 0824820 A	07-11-1996 25-02-1998
US 5550754 A	27-08-1996	NONE	
EP 0665655 A	02-08-1995	US 5446783 A JP 7226807 A	29-08-1995 22-08-1995
US 5661788 A	26-08-1997	KR 135777 B CN 1136753 A	27-04-1998 27-11-1996